ASTRON
Wireless Technologies, Inc.

MODEL 400-4
Yagi AntennaKit
300-500 MHz

Assembly Instructions for MODEL 400-4 Four Element Yagi Antenna for 300-500 MHz

This kit will be both fun and challenging. You can create your own mechanical and electrical antenna design or your can choose one of our designs. These instructions go beyond mere assembly; they show you how to experiment and understand the effects of element length and spacings.

WARNING!!

An antenna is composed of electrical conductors. If any of these conductors come in contact with power lines, **serious injury and even death can occur**. When installing your antenna, make sure that the antenna, its feedline and supporting mast are placed far enough away from any power lines or service drops so that the antenna and feedline can't come in contact with them, even if the antenna should fall, either during installation or in a future accident.

Likewise, dangerous voltages and RF radiation exist in the antenna when it is being used for transmitting. Turn your power off when handling the antenna. *Make safety your first priority*. Be sure to attach the safety warning label to the boom during assembly.

Warranty

Astron Wireless Technologies, Inc. AntennaKits are warranted to be free from defects in materials and workmanship for two years from the date of purchase. We will promptly repair or replace any item which we determine to be defective in material or workmanship. Any products or materilas damaged through either carelessness, abuse, accident, incorrect application, failure to follow the assembly instructions or that have been modified are not covered by this warranty.

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Parts List

The Model 400-4 kit includes all the materials required to build a high performance 4 element UHF Yagi antenna. You can use your own design or duplicate those recommended in this manual. First check the parts received against the list below to make sure that all of the parts are included.

Part No.	Description	Qty.
400-4A	Assembly Instructions	1
D-100	Element Mounting Bracket	3
D-101-010	20" x 3/16" diameter aluminum rod	3
D-117	1-1/8" x 5/8" diameter ferrite beads	2
D-118	8-32 x 1-1/8" slotted panhead screw, stainless	9
D-119	8-32 hex nut, stainless steel	9
D-120	#8 split ring washer, stainless steel	9
D-121	End caps, ¾" x ¾" green vinyl	2
D-122	Cable tie, black, 6"	2
D-123	24" x ¾" x ¾" square aluminum tube, Boom	1
D-124	400-4 Driven Element assembly	1
D-125	Safety warning label	1

Connectors

Note that a connector has not been provided with this kit. This is to allow you to choose one which is compatible with the rest of your system (A PL259 with a UG175 reducing adapter is quite satisfactory). ***Do not add the connector to the antenna until you have added the ferrite beads.*** See the section on "Final Assembly" for more information.

Mounting Harware

Hardware to mount the antenna to your mast or other support has not been provided. See the section on "Boom to Mast Mounting" to help you decide what hardware you should buy.

Preparation

NOTE: Before you start to build your antenna, read through this instruction manual several times. REMEMBER THAT ONCE YOU CUT AN ELEMENT, YOU HAVE DETERMINED ITS MAXIMUM LENGTH!

Yagi antennas have several major design parameters including frequency, bandwidth, gain, pattern, front-to-back ratio, VSWR and mechanical construction. The resistive impedance of the driven element in most Yagi designs ranges from 15 to 35 Ohms. Reactive impedance is most often present as well. Therefore, a center-fed driven element will probably not provide an acceptable VSWR into a 50 Ohm transmission line. This is why most Yagis are combined with an impedance matching transformer such as a Gamma or "T" match and in some cases even a balun.

To simplify your W1JR AntennaKit project, our recommended Yagi designs have a 50 Ohm, non-reactive feedpoint impedance. With our unique, preassembled **"AntennaFeed"** balanced feed system and the components included to attach a ferrite bead current balun, you will obtain a highly efficient impedance match and low VSWR over a very broad bandwidth. The ferrite bead current balun prevents power-wasting interference from feedline re-radiation so common in unbalanced feed systems like the Gamma match.

The feed system has also been built with our **"EverSealed"** process to protect the critical feed point components from corrosion and the environment.
Our 12" flexible feedline interface makes connection to your feedline a snap - no jumper cable should be necessary.

TABLE 1
Specifications for Model 400-4 Yagi Antenna

Center Frequency, MHz	300-500
Gain, dBd	7 minimum
Front-to-back ratio	15 minimum
VSWR (50 Ohms)	1.2:1 typical
1.5:1 bandwidth, %	5 minimum (22 MHz at 440 MHz)
3 dB beamwidth, E/H planes, deg.	60 and 90 typical
Maximum output power, Watts	100 (limited by feedline power rating)
Termination, feet, coax	1, RG58 type
Polarization	Horizontal or vertical
Number of elements	4
Boom length, feet	2
Boom material	6061-T6 aluminum
Weight, pounds	1.5

Selecting Your Design

The recommended designs shown in TABLE 2 have an excellent gain to boomleng ratio, a very clean radiation pattern and broad bandwidth (see the specifications c TABLE 1 above). To simplify construction, the basic design has been scaled to man different center frequencies between 300 and 500 MHz, and the recommended eleme lengths and element spacings are shown in TABLE 2. Note: all correction factors hav been applied to the dimensions in TABLE 2 including corrections for the presence c the boom mounting bracket and scaling element diameter. No further corrections ar required.

Construction using TABLE 2

First, choose your desired center frequency, then copy the recommended dimension for element lengths and element spacings (dimensions “A” through “G”) from TABL 2 to the appropriate spaces on FIGURE 2. If your desired center frequency is not o TABLE 2, interpolate the dimensions as described below.

Interpolation

Dimensions for center frequencies between 300 and 500 MHz that are not shown o TABLE 2 can be easily interpolated. For example, if you require a center frequency o 435 MHz, calculate dimensions halfway between 430 and 440 MHz, or approximatel 13-3/32, 12-13/16, 11-5/8, 4-19/32 and 5-3/16 inches respectively for dimensions “A” through “G”.

Preparing the Boom

1. Locate the square boom and designate one end as the front.

2. Place a mark 1-1/2” from the front of the boom. This is the center location for Director Element #2 and the reference point for the next element location. (See FIGURE 2).

3. From this first reference point, measure dimension “G” and mark the center location for Director Element #1 on the boom.

4. From this new reference point, measure dimension “F” and mark the center location for the Driven Element on the boom.

5. From this new reference point, measure dimension “E” and mark the center location for the Reflector Element on the boom.

6. From the element center locations for the Reflector and Director elements, measure, mark and center-punch the location for the holes for the element mounting brackets. Measure the holes 3/8” on either side of the element center locations. Be sure to put the marks in the exact center of the boom.

7. From the element center location for the Driven Element, measure, mark and center-punch the location for the mounting holes for the driven element assembly. Measure the holes 1-3/8" on either side of the element center location. Be sure to put the marks in the exact center of the boom.

8. **Double check your dimensions before proceeding.** Drill a hole at each center punch mark completely through the boom for the element mounting screws. Use a drill of approximate hole diameter of .177" (#16). After drilling the holes, deburr the holes on both sides of the boom.

Boom to Mast Mounting

Before you cut the boom or mount the elements to the boom, you should decide how you will mount the boom to your mast. Most people will probably prefer to use a rectangular plate interface with "U" or "V" bolts as shown in FIGURE 1A. This method is quite strong and will keep the antenna aligned in cases of windy condition. FIGURE 1B is a simpler but also acceptable method using one strong "U" or "V" bolt (at least 2" wide by 5/16" diameter) and a mounting block. Either way, remember to prepare the boom before mounting the elements.

FIGURE 1 Typical Mast Mounting Configurations

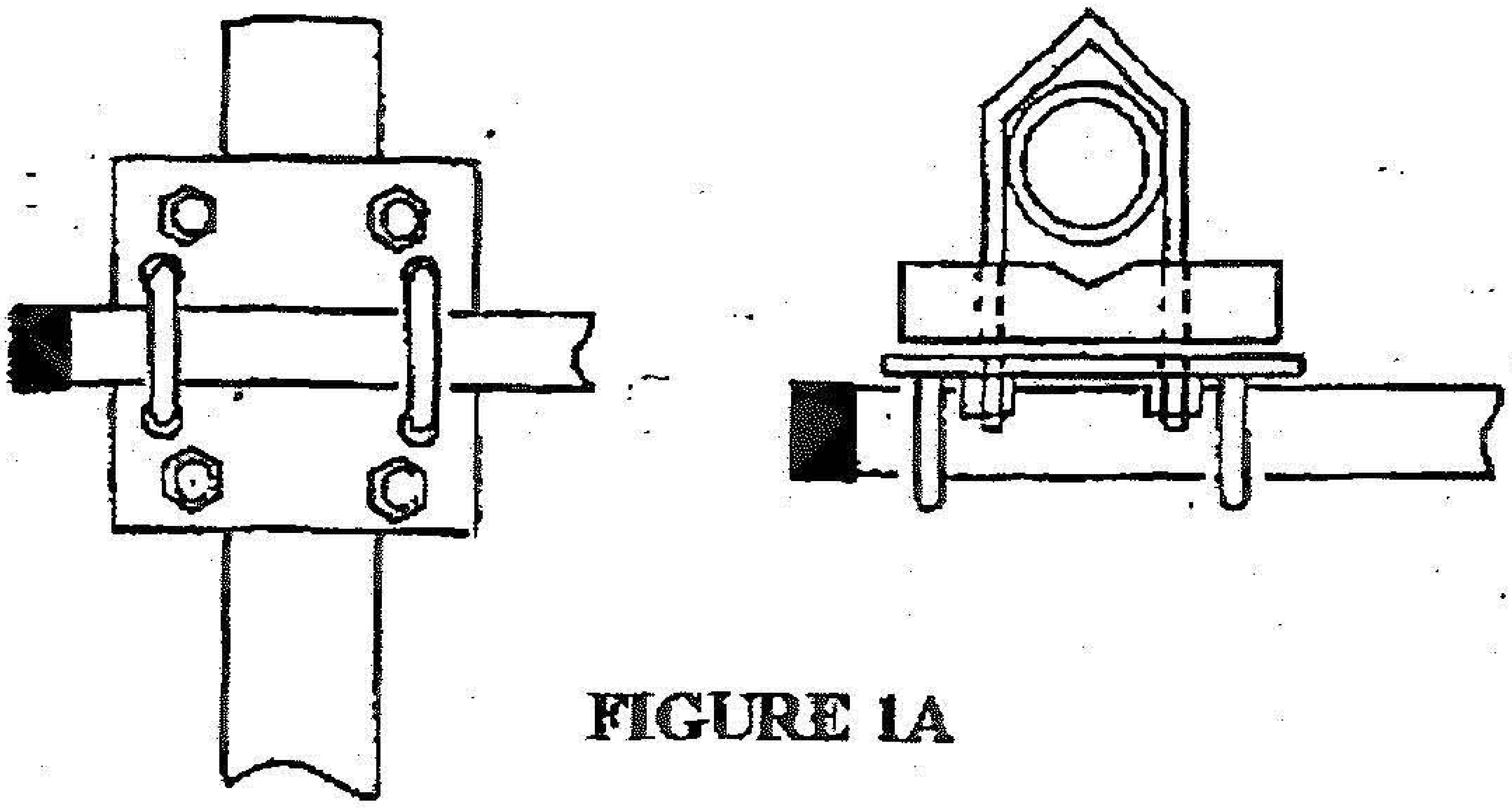


FIGURE 1A

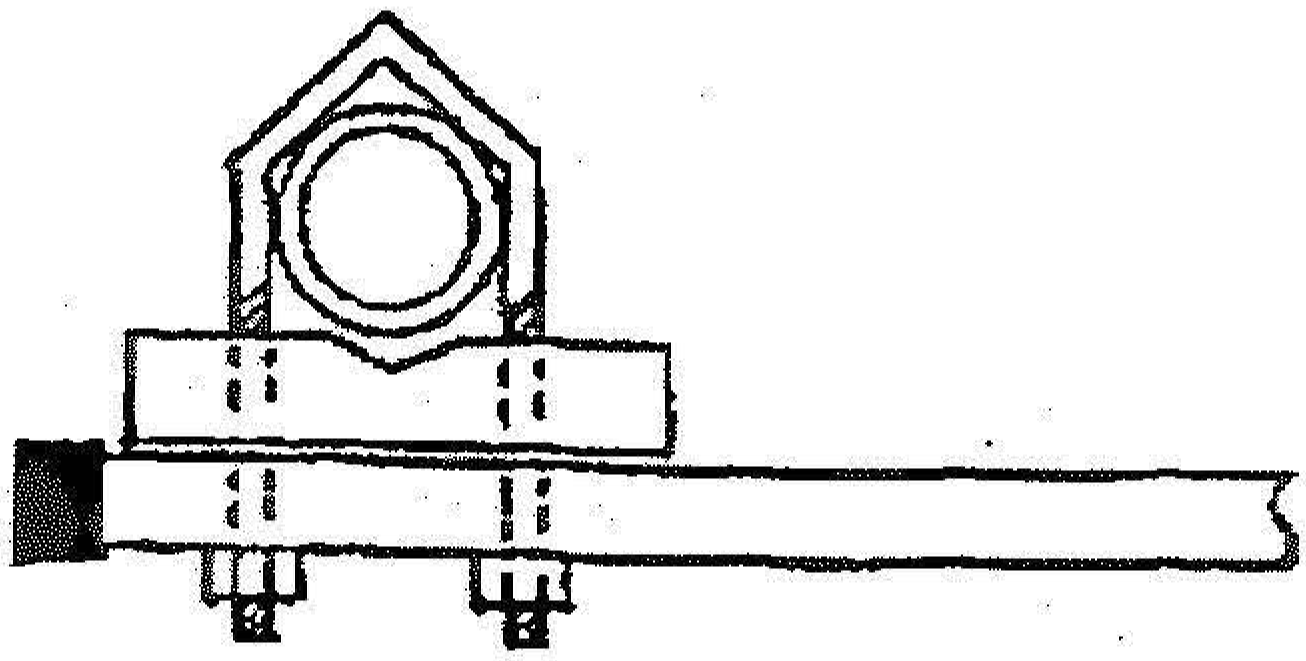


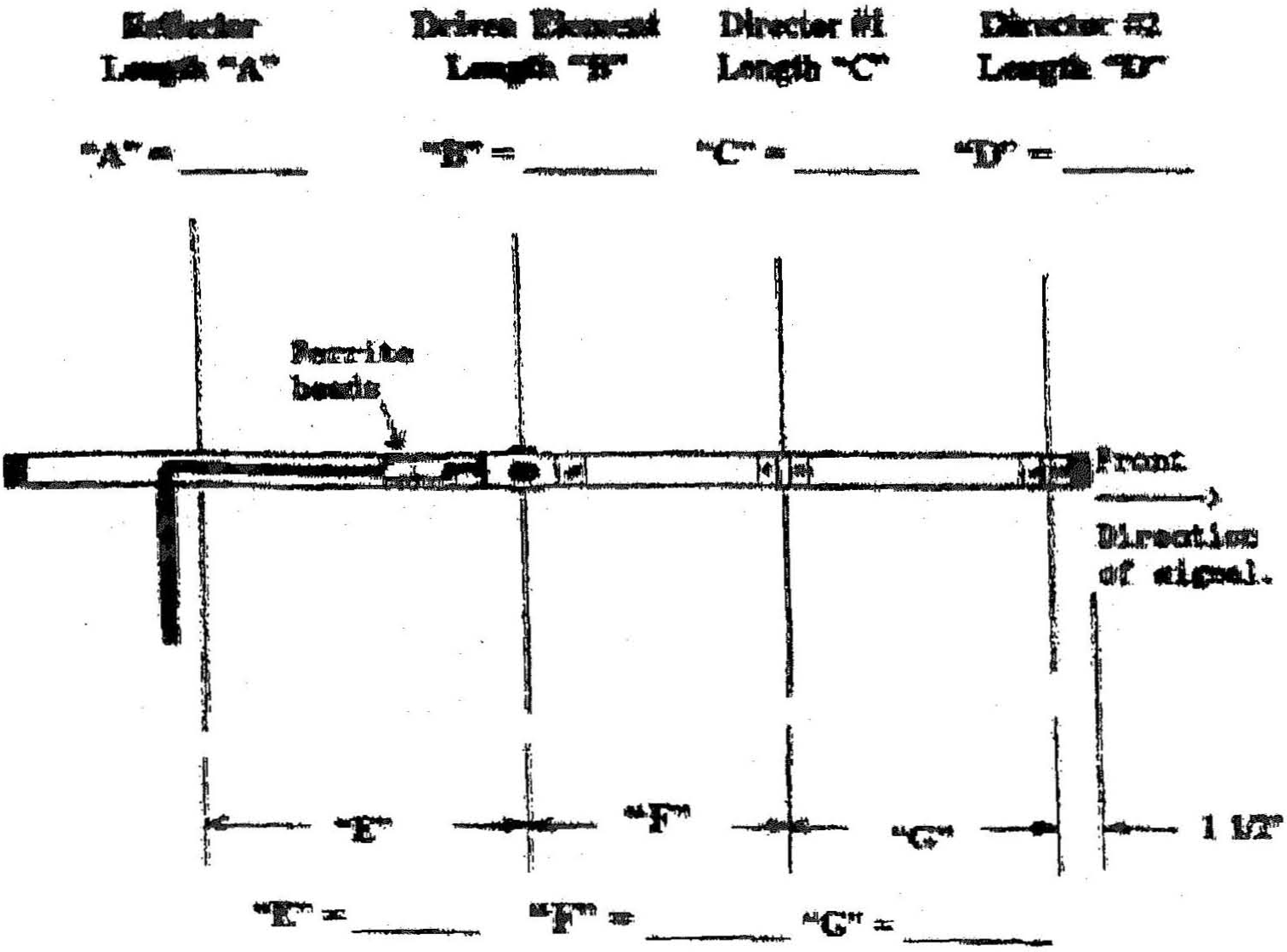
FIGURE 1B

TABLE 2

Recommended dimensions in inches (+/- 32") for a 4 element UHF Yagi

Center Frequency (MHz)	Reflector Length "A"	Driven Element Length "B"	Director #1 Length "C"	Director #2 Length "D"	Element Spacing "E"	Element Spacing "F"	Element Spacing "G"
300	19-11/16	18-11/16	17-13/16	17-1/16	6-11/16	3-3/4	7-1/2
310	19-1/32	18-1/16	17-7/32	16-15/32	6-7/16	3-5/8	7-1/4
320	18-7/16	17-1/2	16-11/16	15-15/16	6-1/4	3-1/2	7-1/32
330	17-7/8	16-31/32	16-5/32	15-7/16	6-1/16	3-13/32	6-13/16
340	17-3/8	16-15/32	15-11/16	15	5-7/8	3-5/16	6-5/8
350	16-7/8	16	15-7/32	14-17/32	5-11/16	3-7/32	6-7/16
360	16-3/8	15-1/2	14-3/4	13-9/16	5-9/16	3-1/8	6-1/4
370	16	15-1/16	14-3/8	13-3/4	5-7/16	3-1/16	6-1/16
380	15-9/16	14-11/16	14	13-3/8	5-1/4	2-31/32	5-15/16
390	15-1/8	14-5/16	13-5/8	13	5-1/8	2-7/8	5-3/4
400	14-3/4	13-15/16	13-1/4	12-11/16	5	2-13/16	5-5/8
410	14-3/8	13-9/16	12-15/16	12-3/8	4-7/8	2-3/4	5-1/2
420	14-1/16	13-1/4	12-5/8	12-1/16	4-3/4	2-11/16	5-3/8
430	13-3/4	12-15/16	12-5/16	11-3/4	4-5/8	2-5/8	5-1/4
440	13-7/16	12-11/16	12-1/16	11-1/2	4-9/16	2-9/16	5-1/8
450	13-1/8	12-3/8	11-3/4	11-1/4	4-7/16	2-1/2	5
460	12-7/8	12-1/16	11-1/2	11	4-3/8	2-7/16	4-7/8
470	12-9/16	11-7/8	11-1/4	10-3/4	4-1/4	2-3/8	4-3/4
480	12-5/16	11-9/16	11	10-1/2	4-1/8	2-5/16	4-9/16
490	12-1/16	11-3/8	10-3/4	10-1/4	4-1/16	2-5/16	4-9/16
500	11-13/16	11-1/8	10-9/16	10-1/16	4	2-1/4	4-1/2

FIGURE 2. Typical Layout for a Four Element Yagi



Element Cutting

Mark your predetermined lengths on the elements as taken from you FIGURE 2 dimensions. For the **Driven Element**, keep in mind that you have to split the difference of the measurement and cut both ends equally so that the mounting block stays at the center of the driven element assembly and the tip-to-tip length equals dimension "B".

Recheck your dimensions. Then cut the elements to length with a fine-tooth hacksaw and smooth the tips with a file.

Final Assembly

Now prepare the feed system. First slide the two ferrite beads together over the coax cable until the first bead is about 1" from the feed block. Apply tape or heat shrink tubing around the ferrites to hold them in place Now you can attach your connector to the end of the cable.

Mount the driven element assembly to the boom so that the feedline faces the rear (mast end) as shown in FIGURE 2. Attach the safety warning label to the boom. Attach the Reflector and Director Elements to the boom using the element mounting brackets, screws, washers and nuts provided. Make sure the elements are centered and perpendicular to the boom before tightening the nuts. Install the end caps on either end of the boom and attach the coax to the boom using the cable ties.

Final Testing

If you used the dimension provided on TABLE 2, your antenna should be right on frequency and no tuning is required. However, if you care to test your antenna, place it in a clear location away from other antennas and metal objects. Then connect a VHF type (not an HF type) VSWR meter in the transmission line either at the connector or at your transmitter, whichever is more convenient. If the VSWR is over 1.5:1, check the connector attachment, element lengths and element spacings. A short circuit across the connector means the connector was improperly installed. Remember, though, that a VSWR less than 2:1 is quite satisfactory and will result in very little signal loss.

Your antenna is now ready for final installation. Best performance will be obtained if you mount the antenna in a clear high location as far away from other antennas as possible. For best long-term reliability, we have provided you with our "EverSealed" antenna feed which eliminates moisture and contamination at the antenna feed point. Just seal your connector with tape or a suitable sealer to prevent moisture from entering the connector.

CONGRATULATIONS

You have successfully constructed an Astron AntennaKit and you did it your way! The philosophy behind the kit is to have fun, test you understanding of antenna design and construction and enjoy the performance of your antenna.

We would like to hear from you with any suggestions for other kits or construction techniques. Please feel free to send photos, drawings and comments to us for evaluation. We'd like to see your contribution to the state-of-the-art.